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Electric Vehicle Architecture E-Flex

Electric Driving with E-Flex

Two engines on board – but completely new concept compared to conventional hybrids

General Motors presents the third variant of its electric vehicle architecture E-Flex, the Opel Flextremer. Its energy source is a battery that powers the electric motor. Another energy source on board – such as a hydrogen fuel-cell or combustion engine – provides more power to increase operating range. In the case of the Flextremer, this is a 1.3-liter CDTI diesel engine. Electric propulsion and a combustion engine are used in a manner fundamentally different from that of conventional hybrid propulsion vehicles. Regardless of the Flextremer's operating mode, it is always electrically powered. The diesel engine is onboard solely to power the generator and charge the battery, always running in optimum operating range.

The Flextremer can be charged in around three hours via a standard 220 V electrical socket. A fully charged lithium-ion battery gives the concept car a range of around 55 km in purely electric operating mode. When the battery is run down and no electrical socket available, the Flextremer's common-rail diesel engine operates at constant rpm to provide electricity and recharge it. The journey need not be interrupted or stopped.

A commuter who lives within 50 kilometers from his workplace, and therefore has a round-trip commute of 100 km every day, would need no diesel and therefore emit zero CO₂ with the Opel Flextremer. The only requirement is that he charges up his car each evening and during work. But even if the owner forgets to recharge or travels on vacation in the vehicle, the Flextremer remains economical: it emits less than 40 g/km CO₂ in combustion mode, thanks to its efficient engine configured for generating electricity. This increases the car's range.



Diesel engine: With modern, cylinder pressure-based combustion control

The concept car's diesel engine also features the newest technology to further reduce exhaust and noise emissions. The closed loop technology is used to control the combustion process.

High-speed Piezo sensors integrated in the glow plugs measure the pressure in the cylinder, so the injections can be matched to the actual combustion in real time. The 1.3-liter four-cylinder engine is the second unit from GM to feature this innovative system, after the 2.9-liter V6 engine displayed at the Geneva Motor Show.

E-Flex system: Flexibility for propulsion systems and energy sources

With the General Motors E-Flex concept, different propulsion systems can be fit into one uniform chassis with electric drive. The aim is to support global diversification of the "energy mix" and to establish the electricity power grid as an energy source.

"Our E-Flex strategy is attractive because we can use different propulsion systems in the same vehicle architecture, depending on which energy source is locally available," said Larry Burns, GM Vice President, Research & Development and Strategic Planning. "E-Flex ensures flexibility on two levels in terms of the propulsion system and the energy sources. We can extract hydrogen or electricity either from a wide range of renewable sources – such as wind, solar, geothermic, hydro or biofuel – or from traditional sources such as natural gas, coal, nuclear power, and even gasoline or diesel."

General Motors has already unveiled two further E-Flex variants this year:

- At the Detroit Motor Show in January 2007, the Chevrolet Volt debuted with a 1.0-liter three-cylinder turbo gasoline engine designed to operate on gasoline or E85, a mixture of 85 percent ethanol and 15 percent gasoline.
- At the Shanghai Motor Show in April 2007, GM presented the Chevrolet Volt with enhanced hydrogen fuel cell propulsion. With four kilograms of hydrogen on board,



the fuel-cell powered Volt has a range of up to 480 kilometers.

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Text and photos can be downloaded from the Internet at <http://media.opel.com>.

Overview of propulsion technology technical data:

Description:	Electric propulsion with onboard Range Extender, recharging via power grid
Battery system:	
Type:	Lithium Ion
Energy content:	16 kWh (minimum)
Peak output:	136 kW
Voltage:	320 to 350 V
Time to full charge:	3 to 3.5 hours at 220 V line voltage
Electric propulsion system:	
Electrical peak output:	120 kW
Peak torque	322 Nm
Generator:	
Peak output:	53 kW
Range Extender:	
Type:	Four-cylinder turbo-diesel engine
Displacement:	1.3 liters
Rated rpm:	1500 to 1800 rpm
Peak rpm:	3200 rpm
Tank capacity:	26 liters
Charging unit:	
Type:	Power plug
Voltage / Amperage:	220 V / 15 A
Range (pure electric propulsion):	55 km
CO ₂ emissions / km	less than 40 g according to European test procedure ECE R101 for range extender vehicles